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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

JULY 1, 1988

Is there a RECESSION AHEAD?
Forecasting the economy through 1989 PAGE 24

How wafer-fab shortages are hurting chip makers PAGE 16

Sending the salesforce back to school PAGE 62

Lester Thurow, MIT economist

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES – WORLDWIDE

VOL. 14, NO. 13 JULY 1, 1988

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Cover photo: Dave Bradley

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What recession?

Is there a recession ahead? It depends on who you talk to.

Lester Thurow, dean of the School of Management at the Massachusetts Institute of Technology, is bullish on the economy. Ravi Batra, author of *The Great Depression of 1990*, is decidedly not.

Who's right? We're not sure, but we tend to be perennial optimists at ELECTRONIC BUSINESS, so we put Thurow on the cover and relegated Batra to the inside pages. Besides, most of the people whom we talk to every day are optimistic, too. And if you can't believe your friends, who can you believe?

Thurow and Batra, boom and gloom

Count those beans

Just to be on the safe side, though, we recently sent out a questionnaire to 700 chief financial officers, vice presidents for finance and controllers in the electronics industry. Altogether, 99 responded, for a highly respectable response rate of 14.1%. The results — which are published in this issue — are worth examining.

What we like about this survey — and we do it every year — is that CFOs tend to be a conservative lot. Unlike CEOs, who get paid to be bullish, CFOs rarely make outlandish claims about their companies. They're paid to count beans. And they're not going to count beans if there are no beans to count.

That's why if most CFOs polled see modest growth in the year ahead, we believe them. And if they see the economy slowing, but not disastrously so, in 1989, we believe them about that, as well.

The CFO survey, the interviews with Thurow and Batra, and the introductory article to our "Midyear Update" were provided by associate editor Bruce Rayner. The statistical data on the various segments that make up the electronics industry were compiled by contributing editor Lin Sun.

There's a wealth of economic and financial information in this edition. We hope you find it useful.

AL FURST, Editor

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WORMware

I enjoyed reading your very informative article on the subject of WORM [write-once, read many times] devices and optical drives. You noted several companies such as FileNet and Laser Magnetic Storage International, but Data/Ware Development in San Diego was not mentioned.

Data/Ware's Mainframe Optical Storage Transport (MOST) provides optical storage while emulating a 3480 emulation with an order of magnitude increase in storage.

MOST fits applications where large amounts of data or permanent value are required to be on line. Access to a virtual tape is measured in seconds. This is all accomplished in a fraction of the floor space required by other technologies. The MOST system is the optical equivalent of an IBM 3480, one A22 and one B22, but much more cost effective on a dollars/megabyte basis. Fully automatic jukebox systems are also available.

KENYON R. CRUDEN
Vice President
Peripheral Systems
Data/Ware Development Inc.
San Diego, Calif.

We're unique, too

In response to your article on Sybase Inc. of Jan. 15, 1988, [which states that Sybase, a Berkeley, Calif., software company, uniquely offers referential integrity and two-phase commit on its relational database management systems], we have identified 22 features that are unique to Empress and aren't available from the competition. None of our competitors offer these advantages to the RDBMS user.

We define our main competition in the market as being: Oracle, Informix, Unify, Ingres and Sybase. It's interesting to note that [nearly] all of these competitors recently bid on a very major computerization project being undertaken by Treasure Chest, of Glendora, Calif., the leading publisher of color inserts in the world. The project represents one of the largest commercial Unix applications and Empress was chosen as the RDBMS.

You might wonder, if we're so good, why do we have a low profile? Empress Software Inc., formerly called Rhodnius Inc., is a very young company that is just beginning to develop a recognizable presence in the end-user market. The company originated in 1979 when myself and Ivor Ladd, now vice president of technology for Empress, decided to commercialize work we had done as graduate students with the Database Research Group at the University of Toronto.

Our first Empress product was shipped in 1981. In the early years we sold mainly to OEMs, systems developers and integrators. With the introduction of products into the VMS and DOS markets in 1986, we began to focus on the end-user market. Our major clients in the U.S. include: Boeing, Auto-trol, Singer-Link, Westinghouse, Ford Aerospace and the Jet Propulsion Laboratories.

Calling ourselves the world's most advanced RDBMS is not marketing hype. We stand by our claim.

JOHN KORNATOWSKI
President
Empress Software Inc.
Toronto, Canada

We're swift

I found your magazine's new format a meaningful improvement upon an already excellent standard. Information has been presented in a more accessible fashion, without compromises on the quality and depth of your editorial content.

I believe one oversight was made in the list of the 100 fastest growing companies compiled in the May 1, 1988 issue. With 23.8% sales growth and 41.9% growth in net income over the past five years, Diceon Electronics would rank as the fastest growing company in the components segment. On the overall ranking of 100 companies, Diceon (fiscal 1987 revenue of $111.1 million) would rank 55th.

EDWARD B. KEANEY
Burns Pauli & Co. Inc.
Institutional Securities
St. Louis, Mo.

It's in the cards

We read with keen interest your article entitled "Memories are made of . . . tough little cassette cards," on page 43 of your April 1, 1988 issue.

In the article it says that Du Pont claims to be the only U.S. company to market the cards. We would like to correct that. ITT Cannon has had a major program underway in the U.S. for the last year and a half.

W.J. CLARK
Director, New Product Development
ITT Cannon Components Division
Fountain Valley, Calif.

Clarification

Oops! SMT production-equipment makers aren't **that** flush with orders

Regarding our April 15, 1988, story entitled: "These are glory days for SMT production gear firms," SMT equipment execs might wish that it were so, but U.S. consumption won't be 377 million units this year, as we mistakenly stated. The chart on page 78 was wrongly labeled. Instead of "millions of units," it should have read "millions of dollars," as indicated correctly in the text of the story. Our apologies to our source, Technology Forecasters.

Letters to the editor

ELECTRONIC BUSINESS welcomes letters to the editor on any topic of interest to our readers. If not written on organizational letterhead, all letters must include a telephone number. ELECTRONIC BUSINESS reserves the right to edit letters.

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Chip makers tell DOD: Let us sell rad-hard chips overseas

Harris and others claim the DOD ban on foreign sales of rad-hard chips shuts them out of Europe's satellite boom

Makers of radiation-hardened chips are fighting mad and they aren't going to take it anymore.

What they're not going to take is a 3-year-old ban on exports that does not allow chips that withstand more than 100,000 rads (a measure of radiation) to be shipped overseas. These chips are not necessarily for direct military application: they are primarily targeted at European communications satellite programs, a market that was worth $100 million to semiconductor vendors in 1987, according to market researcher Dataquest Inc., and which may now be out of reach for many vendors.

A task group will meet this month to debate the rad-hard issue, and then plans to present the Department of Defense — the source of the restriction — with a "white paper" offering suggestions for change. The team — officially the 13.4 subcommittee of the Joint Electronic Device Engineering Committee (JEDEC), a group sponsored by the Electronic Industries Association with military chip standards as one of its main charters — will review options that include case by case analysis of the security status of the countries to which rad-hard chips are sold; and case by case studies of the products themselves.

Change is needed, claim task group members from Harris Corp., Intel Corp., National Semiconductor Corp. and others, because the United States is losing money, market share and friends by imposing an "arbitrary" ban based on radiation hardness rather than on other criteria.

The intent of this ban, according to the DOD, is to keep technology critical to the United States from reaching "enemy" or non-friendly hands.

"Russia doesn't have to do any research and engineering if they can buy it," charges DOD engineer Sid Mason, a spokesman on rad-hard policy issues. "It's their modus operandi. Diversions are going on all the time. What will it do to the U.S. technology lead?"

But task group members say that a ban based on radiation hardness levels protects the wrong technology.

"This [ban] is not a way to keep technology safe," contends Joe Tirado, manager of business development for military and high-reliability programs for Harris. Tirado, a JEDEC committee member, is authoring the white paper on the subject. "This is not a radiation issue. It's a technology issue," he argues.

Making no sense

Using radiation hardness as a guideline "is not preventing critical technology from going overseas," Tirado says. "Bipolar devices are inherently rad-hard, and because of that, you can't ship devices that are 10 years old. You couldn't ship vacuum tubes based on that criteria. It makes no sense."

Another task group member, who requested anonymity, notes that many of the parts banned by the DOD are available outside the United States from other sources. "It doesn't do the security of this country any good to not make them available from here," he says.

The DOD, however, has its own view of the situation. "I hear what they're saying," says DOD engineer Mason, "but in reality their view is parochial. Who would want to use bipolar devices on a satellite? It takes too much power. That argument is moot."

Mason also argues that the communications satellite market only requires radiation hardness levels of between 30,000 rads and 50,000 rads, so the 100,000 rads ban is actually "generous."

"All we're asking is that these companies live with this restriction," Mason says, "and many have. Harris has lived with it." In fact, since 1985, Mason says the DOD has received "several hundred" export license applications to sell into the communications satellite market.

One reason semiconductor vendors are agitating for change in this policy is the relative growth of the European aerospace market, which could account for 30% of the total consumption of chips for satellites by 1991, according to Dataquest. With the U.S. space program set back significantly, semiconductor suppliers are trying to reach offshore sources with their technology.

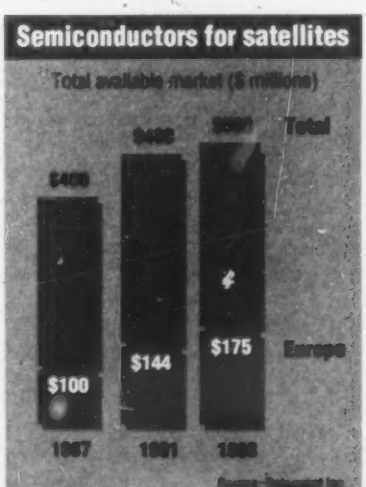
But often they are prevented from reaching these offshore sources. Under this ban, Tirado estimates that Harris has lost $10 million over the past three years.

And that is not the only negative impact. "The DOD believes in keeping the hottest technology to ourselves, and they are ignoring the fact that the Japanese could come in and take over," says Dataquest analyst Greg Sheppard. "They [the DOD] don't care," he says.

And thanks to this ban, the Europeans are moving in on this market as well, Sheppard notes. "The Europeans are trying to take away business in the communications satellite market."

So does the JEDEC subcommittee have a chance for success? Market watcher Sheppard, although he supports the effort, is dubious. "It's going to have to come from the top," he says. "The DOD doesn't stick its neck out."

VALERIE RICE



Europe's satellite-chip market is growing fast, but U.S. chip makers say the Pentagon locks them out of it

West Germany welcomes U.S. telecom gear

Germany is quickly deregulating its telecom sector — and inviting bids from U.S. modem, switch and phone makers

The "auslanders need not apply" signs are coming down all over Germany. Foreign electronics companies are discovering that the doors to the once-closed West German telecommunications market are beginning to open — at least a crack.

What this means short-range is that U.S. electronics companies will be able to sell equipment — such as switches, mobile radios and radio pagers — to the Deutsche Bundespost, the West German postal and telecommunications authority.

Longer term, Bundespost officials promise that many other barriers which have restricted foreign firms in the German market will be lifted, thus giving a considerable boost to U.S. telecommunications exports to West Germany.

Chancellor Helmut Kohl's goverment is embarking on an effort to convince foreigners that it is serious about deregulating its telecommunications markets. At the same time, however, some analysts note that the measures announced so far are limited in scope and are largely targeted to new services which don't bring in revenue for the Bundespost.

The deregulatory moves come amidst a backdrop of plans by the European Economic Community to move toward a single unified market by 1992, harmonizing policies, practices and laws in a wide variety of areas. The Community's executive commission is in the process of clearing measures aimed at reducing the monopoly powers of the telecommunications companies in Europe. Throughout the Common Market, controls will ease on sales of telephone sets, modems and other telecom equipment. New markets, like electronic mail, are likely to develop rapidly.

But according to many analysts, progress will be painfully slow in liberalizing the basic telephone setup itself, because it's a big money maker for the various governments in the EEC. In Germany alone, the state-owned Bundespost kicks in more than $3 billion annually in revenue to the federal government. So, it isn't surprising that government officials have tended to view outside competition somewhat cautiously.

Caution sums up the attitude of U.S. executives on the potential of the German market as well. Veronica Haggart, a vice president and a key Washington lobbyist for Motorola Inc., describes the German moves as "very encouraging," especially in the

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mobile radio field.

"But it's still too early to judge the potential long-range effect of the action," adds Haggart, a former member of the International Trade Commission. "We just don't have enough information on how they plan to implement these changes to know if it'll bring any real bonanza for American telecommunication companies in general," she notes.

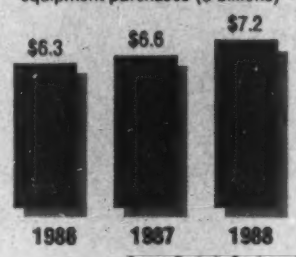
Motorola is gearing up for more activity in the European market, company officials say. They cite the purchase of Storno AB, a leading manufacturer of two-way radios based in Denmark, and the company's stepped-up participation in cellular radio systems in several European countries as examples.

Bernhard Zurhorst, director general of finance and procurement at the Bundespost, says his agency is now "particularly eager" to attract numerous small- and medium-sized electronics companies "which have not yet crossed the Atlantic." Zurhorst and other top-level German officials noted during a recent visit to the United States that the telecommunications market in their country will grow at a 7% annual rate over the next few years.

"We intend to open our entire terminal supply market with one important exception — the telephone network infrastructure," Zurhorst says. These moves will open up sales for the "auslanders" in a wide range of new fields including satellite transmission, radio paging, modems and related software.

German telecom purchases

Deutsche Bundespost telecommunications equipment purchases ($ billions)



Source: Deutsche Bundespost

Germany's telecom authority now has the green light to buy more from overseas

The major exception still off-limits to outsiders is the telephone system itself. Foreign firms, as well as some European politicians, charge that wide open competition in German telecommunications would eventually allow the giant U.S. and Japanese firms to dominate many EEC markets. Nevertheless, Zurhorst indicates that even within this arena, there are legislative initiatives underway which would extend a "competitive environment" to satellites.

The liberalized satellite market will include point-to-multipoint services with low data transmission rates (for example, distributing information to banks, newspapers and insurance companies), and communication service tying together "widely scattered pieces" with relatively low volumes (for example, point-of-sale transmission for department store chains).

In terms of the telecommunications product market, the terminal supply market has been gradually liberalized in recent years.

MARTYN CHASE

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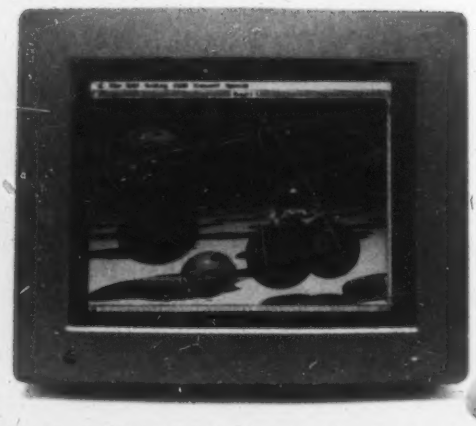

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How to cope with the next recession

The electronics industry may be enjoying a recovery now, but many economists fear a downturn in '89. This is the time for those contingency plans

BY BRUCE C.P. RAYNER

Imagine this. It is October 1989. GNP growth for the third quarter is reported by the Department of Commerce at a negative 0.5%, triggering fears that a recession is in the making. Despite attempts by the Federal Reserve and foreign central banks to intervene, the dollar starts to freefall. Japanese investors pull out of the U.S. bond market, sending prices into a tailspin and interest rates skyward. In sympathy, stock markets around the world begin to slide. The Dow Jones Industrial Average collapses.

By year's end, the electronics industry is feeling the crunch. Bankruptcies are up and capacity utilization is way down. Computer, peripheral, telecommunications and component manufacturers are all reporting slowdowns in orders and shipments, both domestically and internationally. Forecasts for 1990 look even more bleak.

Is this scenario — a severe recession — impossible? No. Is it unlikely? From the vantage point of mid-1988, many noted economists like Lester Thurow, dean of the Massachusetts Institute of Technology School of Management, say that yes, a recession is unlikely (see accompanying story). But while they play down the probability of a serious economic calamity, many also express a deep concern about America's long-term economic health.

Electronics executives should be concerned as well. With the worldwide electronics industry poised to break the $500 billion revenue barrier this year, the industry will become increasingly susceptible to economic cycles. By paying closer attention to economic variables rather than just industry-specific factors, maturing electronics companies will be better equipped to react to the marketplace and track the more moderate long-term growth paths through all phases of the business cycle. "The important thing for us to recognize is that the days of unbroken growth records are over," comments William Conlin, president of CalComp Inc., a $400 million-plus Lockheed Corp. subsidiary that makes computer graphics products.

At the top of the list of economic concerns is the budget deficit. It *has* to be dealt with by the next administration, be it Republican or Democrat, or else the economy will face a dangerous deterioration in future standards of living, economists warn. Fiscal policy tools of both spending cuts and tax increases are suggested. Currently, projections for fiscal year 1988's deficit are close to the $150.4 billion figure for fiscal 1987.

"If you are going to do anything, the time to do it is January or February 1989, and blame President Reagan," suggests Thurow, referring to an implementation of fiscal policy to correct the budget deficit. "If you don't change it in 1989, you are not

Noted economist Lester Thurow—who some say

could be senior economic advisor to the next president—has few doubts about the likelihood of recession.

going to change it in 1990," he adds.

Other economic woes include the rising tide of foreign, corporate, bank and personal debt that could prove disastrous if a recession materializes. For instance, the U.S. interest payment to foreigners is expected to nearly double, from $17 billion in 1981 to $30 billion by 1990, estimates Data Resources Inc. (DRI), an economic forecasting firm. The slow improvements in the trade deficit and the weakening U.S. dollar also contribute to the debt burden. Some economists believe that if the world capital markets were to lose faith in the dollar, there would be little that central banks could do to prop it up.

Economists and industry watchers agree that now is not the time for business leaders to be complacent about the economy, particularly electronics executives. Although the electronics industry appears to be enjoying a healthy recovery, plans should be in place now to minimize the effects of an economic downturn in 1989. Whether the United States will suffer a depression, as maverick economist Ravi Batra predicts, or whether it will continue its mediocre growth, is less important than how well companies are positioned in this time of mounting uncertainty. "It is not too early to start doing your contingency planning and risk analysis and to anticipate which sectors are going to be weaker," advises Edward Henderson, market researcher and president of Los Altos, California-based Henderson Ventures.

Most economists, both corporate and academic, are convinced that the United States will enjoy reasonable economic performance for the remainder of 1988. The Republican party and America's trading partners all want to avoid a recession this year to ensure the election of Vice President George Bush as the next president. The view from overseas is that the Republicans are less protectionist than the Democrats, so foreign governments will be more willing to keep

the U.S. economy afloat until at least after the election. Similarly, the Federal Reserve is willing to play along with the White House so as to give the next president a fiscal policy option in 1989.

Pretty healthy in 1988

The majority of economic forecasts for GNP growth in 1988 range between 2.0% to 3.0%, with both inflation and unemployment kept under control. "For the next six to 12 months, the outlook looks pretty healthy for all businesses that are related to the industrial sector," comments Allen Sinai, chief economist at the Boston Co. Sinai points to a strong amount of spending on information-related equipment and telecommunications both domestically and internationally as evidence of what he labels a boom in electronics.

DRI predicts 2.3% GNP growth for 1988, down from a 1987 growth rate of 2.9%. The real economy rebounded from the October stock market crash of last year and is showing signs of good health. "I think we overestimated the impact of the stock market on the economy," admits David Wyss, chief financial economist at DRI. "We hadn't taken into consideration that 80% of the population doesn't own any stock and only 5% owns a significant amount," he says.

Most executives and economists in the electronics industry share Wyss' view on the nonetfect of the stock market crash. "My feeling is we have weathered the crisis of last October and I now feel we will have good stable growth and a healthy electronics industry this year," says John Mitchell, vice chairman and officer of the board at Motorola Inc. Mitchell is also a director and regional vice chairman of the National Association of Manufacturers and the chairman of the Electronic Industries Association.

James Whittaker, chief economist at Digital Equipment Corp., holds a slightly different opinion. "One thing the stock market crash did at Digital was to make people think a little bit more about the alternatives for the future. Not only did a recession become possible, but a severe recession became possible," he says. Still, Whittaker expects hardware sales growth for the computer industry to range between 10% and 12% for the year, the strongest performance for the past three years. He also expects a mild recession in late 1989 because of "serious economic imbalances."

Most forecasts for GNP growth in 1988 range between 2% and 3%, with inflation and unemployment both under control

DRI's Wyss also believes that 1988 will be good for electronics and pegs the industry to grow at a 10% rate for the year. DRI's capital spending survey points to an 8.8% increase in 1988 over 1987 for plant and equipment spending, close to the Commerce Department's figure of 8%. Exports will strengthen during the year and the dollar will drop to about 115 yen by the election, Wyss predicts. He does not expect a recession in 1988, but there is a possibility in late 1989 or early 1990: "That is the next danger point in the economy," he warns.

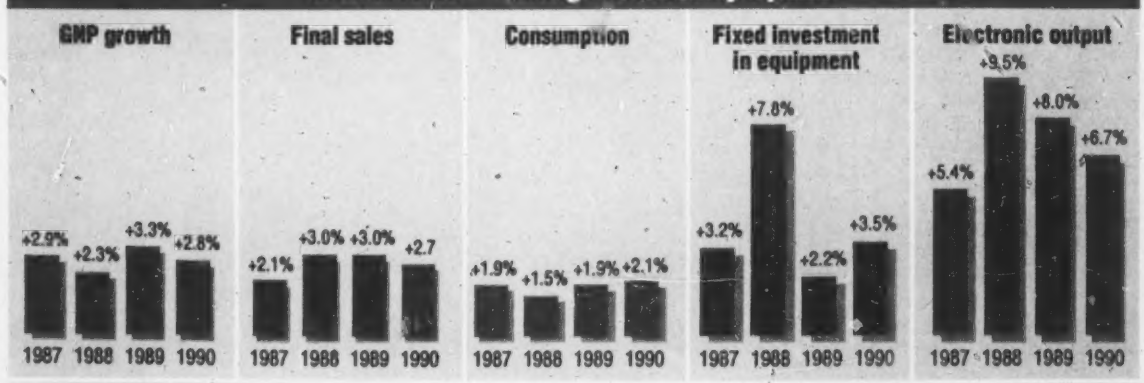
Bullishness prevails

Alan Reynolds, chief economist at Morristown, New Jersey-based Polyconomics Inc. and a staunch supply-sider, is also bullish on the economic outlook. "There is nothing fundamentally wrong with the economy," he says. "It continues to show good growth in production, employment and income, and as for the inflation picture, there is not much evidence that it will get worse."

Reynolds puts the threat of U.S. protectionism at the top of his list of concerns for the future of the U.S. economy. "It seems the trade deficit is less important than what you intend to do about it," he says. Any legislation designed to limit foreign buying patterns would be counterproductive to U.S. industry, particularly at a time when exports are leading U.S. growth, he adds.

At the other end of the forecasting spectrum is Ravi Batra, professor of economics at Southern Methodist University and author of the best-selling book, *The Great Depression of 1990*. Even though he is forecasting a devastating six-year depression, Ba-

Growth rates — Taking the economy's pulse



Sources: Data Resources Inc. and Henderson Ventures

tra expects 1988 and 1989 to be relatively stable (see accompanying article). Where Batra and Reynolds diverge is in their reading of the long-term health of the economy.

Batra points to a growing uneven distribution of wealth as an indication that the economy is destined for trouble. He combines that with a theory of economic cycles that predicts economic calamity every 60 years. By his reckoning, these two will come together in 1990 to cause a depression far worse than the one in the 1930s.

The word for 1989 from Robert Eggert's Blue Chip Economic Indicators newsletter, a consensus forecast of over 50 economists, is for 2.2% GNP growth in 1989. However, there is an unusually large range between the optimists, at 3.8%, and pessimists, at -1.7%. Eggert himself expects a recession to hit in 1989. However, the prospects for computer and office equipment shipments look bright: Eggert expects shipments to hit $60 billion in 1988, rising to $62 billion by 1989. Still, he recommends caution: "If I were in big business, I'd sure have a plan to pull in my horns real quick if I had to."

Henderson agrees with Eggert's scenario, and has an economic recession pegged for late 1989, extending into 1990: "My scenario calls for the next president to increase taxes in 1989, retroactive to the beginning of 1989." The severity of the recession will depend on what legislation is enacted. "My gut feeling is they are going to bite the bullet with a fairly steep tax increase causing a fairly steep recession that will probably last three to four quarters," he says. As for how well electronics will do, Henderson expects the industry to come through the recession fairly well as a result of its stronger export focus. The one caveat is the health of foreign economies.

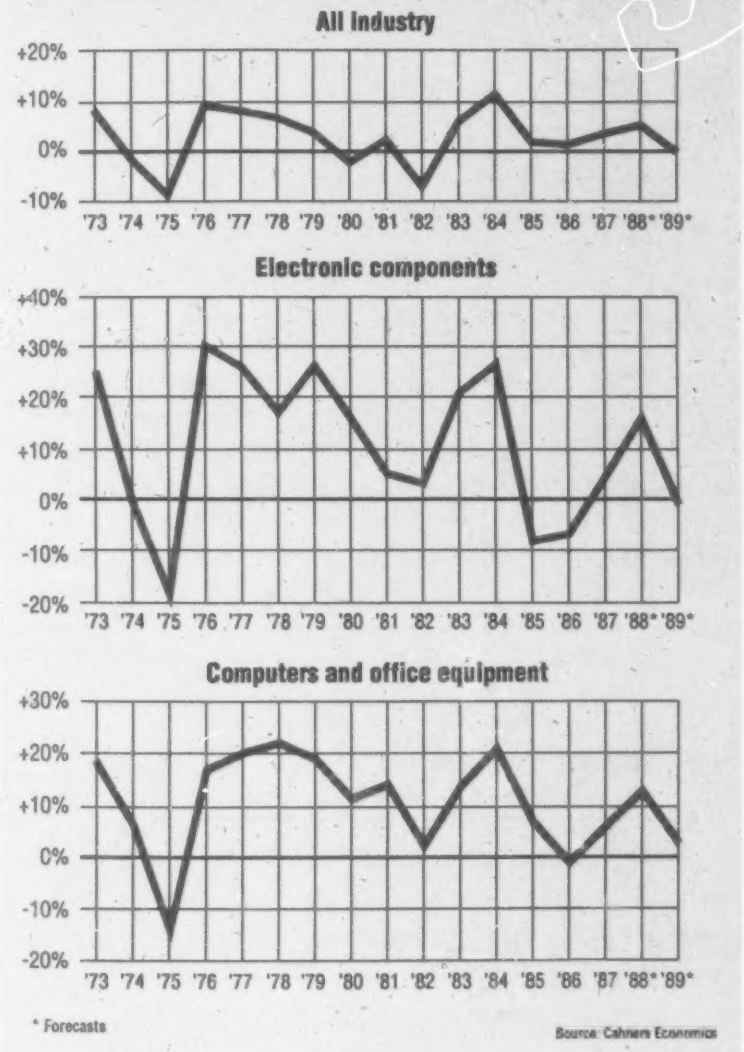
Kenneth McGill, director of technology-intense industry analysis at Wharton Econometrics Forecasting Associates, sees it slightly differently. He expects GNP to hover around 2.9% for 1988 and then slip to 1% GNP growth for the next four or five quarters, before resuming faster growth again in 1990.

McGill is labeling 1989 a "growth recession" year — slow GNP growth coupled with increasing unemployment — brought on by tighter monetary policy leading to higher interest rates and inflation. As far as computer and office equipment is concerned, McGill is forecasting real spending to increase by 7.5% in 1988, dropping to 6.8% in 1989 and 4.5% by 1990.

McGill's scenario calls for monetary tightening in response to increasing inflation and interest rates. Capital equipment spending will be affected, he says, but computer and office equipment investment will come off pretty well. Part of the reason is the low levels of inventories in the electronics industry following the recession of 1985 to 1986. "I think the [illegible] is a conservative posture out there in electronics and that posture will do well for a growth recession

Putting growth in perspective

Industrial production (annual percentage change)



* Forecasts

Source: Cahners Economics

The electronics industry has been volatile, but it looks to be maturing

or a full-fledged recession," McGill says.

McGill points to export growth as the key driver in the economy's health in 1987 and a major contributor to growth over the next two years. He expects exports to slow in 1990 as the dollar begins to gain strength on international markets as a result of rising domestic interest rates. McGill is forecasting the dollar to drop by 8.8% this year in relation to a mix of 40 currencies and again by 3.8% in 1989, before rising in 1990 by a meager 0.3%.

Foreign trade

While the opinion from both executives and economists is that exports are the economy's redemption, progress so far has been painfully slow. While DRI expects the merchandise trade deficit to improve from $171 billion in 1987 to around $141 billion in 1988 and $113 billion by 1990, the improvements to date have not been across the board.

Price-sensitive products, mainly primary products, posted strong export growth in 1987 and in some categories showed surpluses in the current account balance, according to DRI. But in capital goods — including electronics — imports continued to outpace exports, dropping from a surplus of $44.9 billion in 1981 to $3.8 billion last year. Imports of office machinery and data-processing equipment rose last year by 25.8%, outstripping exports and sending the sector into deficit for the first time, DRI reports.

In aggregate, the electronics trade deficit hit $12.7 billion last year, down from a surplus of $7.4 billion in 1980. The American Electronics Association reports that between 1986 and 1987, the balance of trade in electronics between the United States and its 25 top trading partners barely changed at all. While imports rose from $50.6 billion in 1986 to $57.4 billion in 1987, exports increased from $34.0 billion to $40.9 billion.

"If you are going to change fiscal policy, the time to do it is January 1989, and then blame Reagan"
Lester Thurow, MIT

Trade pressure is fiercest in the Pacific Rim, where currencies have been pegged to the U.S. dollar and Americans have come to depend on Asian consumer electronics. While some of the Pacific Rim currencies are starting to inch up, the Hong Kong dollar has yet to budge. Even Japan, the top U.S. electronics trading partner, is absorbing costs to keep its electronics trade balance with the United States at a steady $20 billion.

But it is not only the lack of export penetration in capital goods that is keeping the trade balance in the red. The Department of Commerce estimates that between 1983 and 1986, direct foreign investment in the United States has increased steadily and gives every indication that it will continue this upward trend. The main reason is that a weak dollar is making U.S. factories bargains for dollar-rich foreigners. In electronics alone, direct foreign investment rose from 48 transactions in 1985 to 75 in 1986, valued at $1.8 billion. As for the capital markets, it is estimated that for the last few years, foreigners have been pouring between $150 billion and $200 billion into U.S. stocks and bonds.

Most electronics executives will admit that the dollar is helping their exports, but they all insist that the key to success overseas is a quality product. "For the high-tech industry, it is price-performance and the latest technology that sells internationally," says Thomas Vanderslice, president of Apollo Computer Inc. Apollo does about 50% of its business overseas, mostly in Europe.

While DRI expects the capital-goods trade balance to jump back up to $50 billion by 1990, MIT's Thurow is not so sanguine. He points to the ailing machine tool industry as an example of a domestic industry that is in "the process of advanced collapse." Back in 1978, the American machine tool industry was producing 110% of U.S. demand, says Thurow, but by 1988 that has dropped to 50%. "Even if you had a booming demand for machine tools, it is not obvious that American firms would buy machine tools from American companies," he adds.

While high-technology industry is not suffering to the same degree as machine tools, it does show some of the same symptoms, Thurow says. However, as 1988 wears on, the consensus from most economists is that the weak dollar will spur U.S. high-tech exports. □

The electronics trade balance

U.S. electronics imports and exports (current $ billions)

	1986			1987		
	Exports	Imports	Balance	Exports	Imports	Balance
Japan	$3.5	$24.0	-$20.5	$4.4	$24.5	-$20.1
Other Pacific Rim	6.4	14.0	-7.6	8.3	18.3	-10.0
North America	7.1	5.5	1.6	8.9	6.6	2.3
Europe	12.9	5.9	7.0	15.2	6.4	8.8
Rest of world	4.1	1.2	2.9	4.1	1.6	2.5
Total*	$34.0	$50.6	-$16.6	$40.9	$57.4	-$16.5

* Total includes 25 primary trading partners

Source: American Electronics Association

The electronics trade balance is grim, and still has a long way to go

The word from cautious CFOs: Better safe than sorry

CFOs are often among the most realistic forecasters. While few expect severe recession, most are preparing for some downturn. Here's what they predict

BY BRUCE C.P. RAYNER and MARY DONOVAN

Many chief financial officers of electronics companies are expecting modest growth in the coming year, as uncertainty about the post-election economy mounts.

That's the conclusion of a recent poll by ELECTRONIC BUSINESS of chief financial officers, vice presidents for finance and controllers at 99 U.S. electronics companies. Our annual CFO survey was based on a lengthy questionnaire mailed to 700 chief financial officers in the electronics industry. In all, 99 executives completed the survey for an average response rate of 14.1%.

Results of the survey suggest high-tech CFOs are not inclined to economic pessimism for the rest of 1988 or 1989, even though a growing number are taking steps to minimize the adverse effects of a downturn.

According to a recent ELECTRONIC BUSINESS survey, only 22% of the CFOs and vice presidents for finance polled indicated they expect an economic recession in the coming year. Nonetheless, close to 50% said they are currently taking steps to minimize the adverse effects of a possible economic downturn. The moral of the survey: better to be safe than sorry.

But while some companies expect to feel the heat when the economy softens, others, like Microsoft Corp., think they can weather the storm with little effort. "We feel that the market is there to support the growth in the same potential that Microsoft has been known for," comments Francis Gaudette, vice president for finance and CFO for the software giant. "We are not scaling back relative to any economic condition," he adds.

Gaudette claims that software and other relatively low-cost productivity enhancement investments are countercyclical to the health of the economy in general. If the economy were to turn down, companies would invest in personal computers and software before they bought a minicomputer or a mainframe, he says. For that reason, many workstation vendors and personal computer makers also consider themselves pretty well positioned for 1989.

But for the other half of the industry — those companies that have to pay attention to the economy — an ounce of prevention is better than the bitter medicine. The most popular steps being taken to minimize the effects of the recession by those CFOs surveyed are minimizing inventory, increasing cash reserves, trimming labor costs and postponing capital investment, in that order. Unlike in the early 1980s, very few said they were moving production facilities offshore.

Nearly 50% of CFOs are acting to minimize the effects of a possible economic downturn

For Silicon Systems Inc., an Irvine, California-based maker of standard and custom ASICs, the current economic outlook presents a dilemma: the company needs more foundry space to grow, but could run into trouble with the investment if the economy turns sour. "We are trying to add the capacity that we need in the most cost effective way possible," comments William Bendush senior vice president and chief financial officer of the company. "If there were a downturn in the economy, it would not be beneficial to us."

As far as the effects of the stock market crash on company valuations, 43% of those surveyed responded that the effects had been negative. However, a total of 41% believe that stock valuations of all public companies are currently about right. In terms of the impact of the market crash on sales, an overwhelming 70% said there had been no impact. Sales are expected to grow strongly for the remainder of 1988, but will begin to slow in 1989. While 63% of those surveyed expect sales to increase in the third quarter of 1988, only 54% expect an increase by the second quarter of 1989. As for the outlook on Wall Street for the remainder of 1988, most CFOs expect continued uncertainty in the stock market, but no major changes.

Concerning the presidential election in November, most CFOs expect a Republican to take the reins. However, respondents say the election will either have no effect on the electronics industry or that they are still uncertain about the effect. This reflects either a lack of awareness of what candidate George Bush stands for in economic policy, or a lack of commitment by the candidate himself.

As far as other economic vital signs: CFOs expect the dollar to remain stable and possibly weaken by year's end and the trade deficit to improve in the next 12 months. Surprisingly, 54% of those surveyed expect the budget deficit to get bigger over the next two to three years. Both inflation and interest rates are expected to remain stable or perhaps increase over the next six months, and both labor and precious metals will increase in price, they believe. Acquisition activity is also expected to rise over the next year. □

DEMAND

Over the next four quarters, what do you expect demand to be for your company's product?

	3rd qtr. 1988	4th qtr. 1988	1st qtr. 1989	2nd qtr. 1989
Increase	63%	74%	54%	54%
Decrease	16%	2%	8%	8%
Stay the same	20%	23%	33%	29%
Don't know	1%	1%	5%	9%

BUSINESS DIRECTION

In the second half of 1988, which of the following will change at your company and in what direction?

	Stay the same	Increase	Decrease	Don't know
Manufacturing capacity	41%	55%	4%	0%
Capital investment	46%	46%	7%	1%
R&D investment	41%	55%	3%	1%
Inventories	33%	33%	33%	1%

POSSIBLE RECESSION

In the coming year, do you expect a recession for the economy as a whole?

Yes	22%
No	78%

Is your company now taking any steps to minimize the adverse effect of a possible recession?

Yes	48%
No	50%
Don't know	2%

If your company is now taking steps to minimize the adverse effect of a possible recession, what are they?

Minimizing inventory	35%
Increasing cash reserves	28%
Trimming labor costs	27%
Postponing capital investment	20%
Moving production offshore	6%
Postponing raising funds	2%

INTEREST RATES

In the second half of 1988, interest rates will:

Increase	55%
Decrease	9%
Remain about the same	33%
Don't know	3%

STOCK MARKET

The stock market crash of October 19, 1987, has had what effect on your company's sales?

Positive	5%
Negative	19%
No effect	69%
Don't know	7%

The stock market crash of October 19, 1987, has had what effect on your company's valuation?

Positive	2%
Negative	44%
No effect	49%
Don't know	5%

In the second half of 1988, what do you expect to happen on the stock market?

Another crash	1%
Bear market (down)	18%
Bull market (up)	7%
Continued uncertainty but no major changes	74%

CORPORATE VALUATIONS

Do you believe that public valuations are currently:

About right	41%
Too high	24%
Too low	24%
Don't know	11%

TRADE

Will the U.S. trade deficit continue to improve over the next year?

Improve	52%
Worsen	35%
Don't know	13%

How will trade legislation affect you company in 1989?

Positively	19%
Negatively	28%
No effect	33%
Don't know	20%

What impact will tougher trade legislation have on the U.S. economy?

Positive	21%
Negative	43%
No effect	5%
Don't know	31%

DOLLAR VALUE

In the second half of 1988, do you expect the value of the U.S. dollar in relation to major trading partners' currencies to:

Increase	21%
Decrease	32%
Remain about the same	44%
Don't know	3%

INFLATION

In the second half of 1988, inflation will:

Increase	43%
Decrease	2%
Remain about the same	53%
Don't know	2%

TAX REFORM

As a result of the 1988 tax reform bill, what do you expect your company's 1988 tax burden will be, compared with 1987?

Higher	33%
Lower	22%
About the same	32%
Don't know	13%

MERGERS AND ACQUISITIONS

What will happen to the rate of mergers and acquisitions in the electronics industry next year?

Increase	45%
Decrease	8%
Remain about the same	37%
Don't know	10%

RAISING FUNDS

In the second half of 1988, if your company will need to raise funds, from which market do you expect to get the money?

Bank loan	54%
Private placement	36%
Public market	5%
Bond market	3%
Initial public offering	2%

PRECIOUS METAL PRICES

In the second half of 1988, prices for precious metals used in electronics will:

Increase	46%
Decrease	6%
Remain about the same	32%
Don't know	16%

MILITARY ELECTRONICS

How would you characterize the market for military electronics next year?

Excellent	2%
Good	39%
Fair	53%
Poor	6%

LABOR COSTS

In the next year, labor costs will:

Increase	68%
Decrease	3%
Remain about the same	29%
Don't know	0%

BUDGET DEFICIT

What will happen to the U.S. budget deficit in the next two or three years?

Get bigger	54%
Get smaller	21%
Stay the same	19%
Don't know	6%

Semiconductors

Total U.S. semiconductor consumption
($ billions)

	1988	1989	1990
MOS logic	$4.36	$4.78	$4.63
MOS memory	3.20	3.64	3.33
Linear ICs	1.61	1.65	1.54
Bipolar memory	0.25	0.24	0.21
Bipolar logic	1.56	1.44	1.31
Total ICs	**$10.99**	**$11.75**	**$11.03**
Discretes	1.99	2.03	1.96
Total	**$12.98**	**$13.78**	**$12.99**

Sources: In-Stat Inc., Dataquest Inc.

What's ahead

- Memory chip shortage in DRAMs, SRAMs and EEPROMs. Demand will exceed supply throughout 1988.
- 1989 will show reasonable growth, but recession in 1990 will depress total IC unit sales. As chip shortages ease, prices will fall again, forcing down semi dollar volume.
- RISC chips will challenge standard architecture.
- Compound annual growth rate in the Asia-Pacific region will be 24% between 1987-1992, twice the rate of the U.S. and Japan.

Semiconductor production equipment

Worldwide semiconductor production equipment sales
($ millions)

	1988	1989	1990
Microlithography	$1,423	$1,566	$1,668
Diffusion	248	285	329
Ion implantation	334	489	585
Deposition	1,022	1,176	1,321
Etch	796	896	997
Wafer making	76	81	89
Total	**$3,899**	**$4,493**	**$4,989**

Source: VLSI Research Inc.

What's ahead

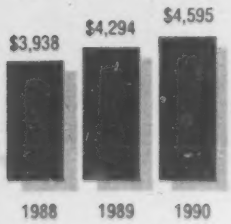
- Overall industry sales will increase 39% in 1988 and 15% in 1989.
- Growth is coming from: the change from a consumer-driven economy to an export-driven one; and from the tight capacity limitations of U.S. semiconductor makers.
- IC equipment makers should be less concerned about a possible downturn than about an excess in ordering.
- Among the segments that will gain most: ion implantation and deposition.

Semiconductor materials and chemicals

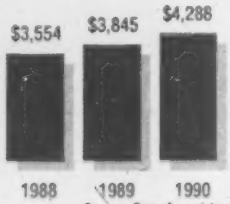
What's ahead

- 1988 will show 12% growth in unit volume of materials and chemicals, and 7% growth in value.
- Japan will continue to be a very strong materials supplier in the U.S. market.
- In the next two or three years, Korean products will emerge in the U.S., claiming up to perhaps 5% of the market.

Worldwide IC fabrication materials consumption
($ millions)



Worldwide IC packaging materials consumption
($ millions)



Source: Rose Associates

Components

What's ahead

- Passive components will show slow growth in contrast to the inflation rate. While sales growth will run in the double digits in most sectors this year, it will slow sharply in 1989.
- Connector revenue growth will slow from 14% for 1988 to under 6% in 1989.
- Capacitor sales will brake next year, with revenue growth of under 4%.

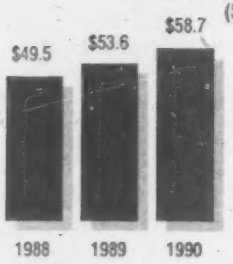
U.S. production of electronic components
($ millions)

	1987	1988	1989
Relays	$580	$681	$698
Switches	632	747	766
Connectors and sockets	3,771	4,318	4,574
Capacitors	2,058	2,392	2,485
Resistors	878	989	995
Printed circuits	4,021	4,753	4,967

Source: ElectroniCast Corp.

Computers

Value of U.S. computer hardware
($ billions)



	1988	1989	1990
Large scale	$9.40	$9.40	$10.20
Medium scale	9.05	9.7	9.85
Small scale	9.7	8.5	9.7
Personal computer	22.58	25.27	28.96
Total	**$49.53**	**$53.57**	**$58.71**

Source: International Data Corp.

What's ahead

- Between 1988 and 1992, the compound average growth rate of U.S. computer sales will be 8% to 9%. New 80386-processor computers will have faster yearly growth at 12% to 13% in 1988 and beyond.
- The Unix market will grow faster than other systems sectors. At present, a third of the market is in mainstream IBM and DEC proprietary systems and a third in Unix and MS/DOS environments.

Computer peripherals — Storage devices

What's ahead

- Write once/read many (WORM) drives are showing up increasingly in applications such as document storage, disk backup and archives.
- Erasable optical disk drives are expected to appear in the market later in 1988, with some shipments in the fourth quarter.
- The flexible disk-drive market continues to suffer from oversupply with price erosion. In rigid-disk drives, overcapacity is expected in the less than 100MB category.
- Tape drive sector is moving to oversupply this year.

U.S. rigid-disk drive and optical storage revenue
($ millions)

	1987	1988	1992
Rigid	$13,057.4	$16,700.7	$28,268.6
Optical	248.0	436.7	$2,995.0

Source: Dataquest Inc.

Worldwide flexible-disk drive shipments
($ millions)

	1988	1989	1990
8-inch drives	$104.9	$47.9	$24.7
5.25-inch drives	1,225.4	1,035.8	828.9
Microfloppy drives	1,048.5	1,241.1	1,388.5
Drives over 5 megabytes	92.0	111.9	164.2
Spiral track drives	10.1	3.6	1.0
Total	**$2,480.9**	**$2,440.3**	**$2,407.3**

Source: Disk/Trend Inc.

Tape drive revenue
($ millions)

	1988	1989	1990
Cassette more than 5MB	$40.3	$50.4	$58.9
Minicartridge more than 5MB	202.3	264.0	313.7
Cartridge 20MB-80MB	268.8	231.3	182.8
More than 80MB	78.1	134.1	194.6
Total	**$589.6**	**$679.8**	**$749.8**

Source: Freeman Associates

Computer peripherals — Display terminals

What's ahead

- Fierce economic battles are being waged for market leadership, and margins have shrunk to the point where few companies show reasonable profits.
- Distribution channels for low-end terminals are moving to mail order/phone order. Major avenue for company growth is in mergers and acquisitions.

U.S. display terminal revenue
($ millions)

	1987	1988	1992
Minicomputer	$934.7	$956.9	$461.0
Non-IBM	118.0	93.2	20.0
IBM 3270	1,212.4	1,222.5	765.0
Non-host	684.0	648.0	464.0
Processing	40.6	82.7	1,005.3

Source: Dataquest Inc.

Computer peripherals — Printers

What's ahead

- U.S. manufacturers will be seen moving production back on shore. Japanese vendors are also setting up manufacturing plants in the U.S. Low labor content in printer manufacturing makes low rates overseas less significant in production.
- Successful implementation of factory automation systems is critical to the ability of vendors to strengthen profit margins.
- Laser printer performance should get a big boost during 1988 with new chip sets and controllers bringing speed more in line with end-user expectations.

U.S. printer revenue
($ millions)

	1987	1988	1992
Serial	$3,213.7	$3,415.3	$3,375.9
Line	1,240.4	1,266.7	1,113.3
Page	2,590.7	3,596.9	5,502.4

Source: Dataquest Inc.

CAD/CAM/CAE

Worldwide revenue of U.S. CAD/CAM/CAE systems vendors
($ billions)

Sources: Daratech Inc., Dataquest Inc.

What's ahead

- More consolidation will be seen in 1988 and beyond.
- Growth rates are slowing, markets are becoming increasingly specialized. Falling workstation prices and oversupply for vendors are the major force behind this trend.
- Overseas markets, especially Europe and Japan, are growing much faster than the U.S.
- Major problem facing most CAD/CAM/CAE vendors is the decline in workstation prices caused by shift toward low-cost workstations and personal computers. Prices have fallen an average of 25% per year since 1984. In 1987, prices fell 20%.

Test & measurement

What's ahead

- 1988 should see double-digit growth at 12%. The overall growth rate will slow down in 1989. The industry should pick up slightly in 1990.
- The international market will have higher growth rates than the U.S. market.
- The devaluation of the dollar is giving market share to U.S. manufacturers in both domestic and international markets. Exports to Japan have been increasing since 1987, a trend that should continue through 1989.
- The highest potential growth in applications will be in the aerospace and defense industry.
- More integration in instrument functionality will be seen during the next five years.

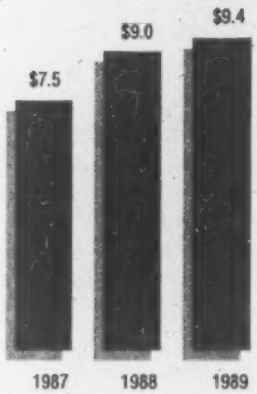
Test instrument sales
($ millions)

	1987	1992
ATE	$1,689	$12,510
Oscilloscopes	1,023	1,675
Logic analyzers	291	650
Microprocessor development systems	477	950
Other instruments	3,549	5,735
Total	**$7,038**	**$12,510**

Source: Prime Data Inc.

Distribution

Sales by U.S. distributors
($ billions)



Source: National Electronic Distributors Association

What's ahead

- Firming prices and stronger exports by customers will produce a 21% improvement in U.S. distributors' sales in 1988.
- Quality is now a major issue for distributors, forcing reevaluation of suppliers and possible fresh rounds of vendor reductions.
- Despite one full point increase in distributors' inventory turn rate over the past year, there is still a need to find ways to fill small orders more efficiently.
- Sales of computer-systems products continuing to grow at larger distributors.

Communications

What's ahead

- Technology is no longer the driving force; market factors predominate.
- Larger companies are becoming the focus of innovation.
- Continued slowness in user buying decisions despite price erosion and an infusion of value-added capabilities.
- Increased emphasis on customer support. Upgradability will be integral to product design and marketing strategy.
- Increased internationalization of telecom markets.
- Connectivity and network management are the keys to account control. Compliance with standards becoming critical.

U.S. telecommunications market revenue
($ billions)

	1987	1988	1992
Public services	$133.3	$142.8	$187.1
Business communications equipment	11.0	11.7	14.3
Public services communication equipment	6.9	7.3	8.6
Data communications equipment	4.9	5.9	9.5

Source: Dataquest Inc.

Comments on industry direction were based on interviews with independent analysts

Instrument makers' comeback to CASE: Beat it or join it

Computer-aided software engineering is shaking up makers of development-systems instruments. Here's how two of them are reacting

BY DAVID CARD

The latest "buzz acronym," CASE — for computer-aided software engineering — is stirring up the instruments market. That's because any system with an embedded microprocessor requires that its software be debugged and tuned up by engineers who have to plug into that system through instruments such as emulators, logic analyzers and microprocessor development systems. Players in this development-systems business, which will amount to $560 million worldwide this year, have to figure out just where they fit in CASE, or risk becoming also-rans.

However, the CASE business is tough to pin down. Most industry watchers define it this way: besides the instrumentation hardware, CASE includes front-end structured design and analysis software, compilers, assemblers and high-level languages, not to mention the computers they all run on. According to Andrew Rappaport, president of Boston market researcher The Technology Research Group Inc., the U.S. market for embedded-microprocessor CASE software is worth only $40 million this year, but could soar to $550 million by 1994.

To get a piece of that elusive market, instrument leader Hewlett-Packard Co., with $8.1 billion in computer and instruments sales, can take its development systems, plug them into its engineering workstations and resell front-end software, calling the conglomeration "CASE."

But smaller instrument companies, such as Applied Microsystems Corp. and Northwest Instrument Systems Inc., don't have the resources to go after CASE head-on. The two private, Pacific Northwest companies, both founded in 1981 and both expecting $20 million in sales this year, have decidedly different approaches: oversimplified, Applied is out to beat CASE, while Northwest means to join it. Their strategies are illustrative of the directions that managers of small companies must take when a significant new technology rolls into town.

Northwest's direction is dramatic: the firm is so keen on CASE that it changed its name. The former maker of PC plug-in instruments calls itself MicroCASE Inc. as of last month. "We want to be *the* software system integrator," says president Lawrence Sutter. "It's kind of analogous to what Mentor is doing on the hardware design side." Mentor Graphics Corp. is the leader of the computer-aided engineering market, with over $220 million in sales last year.

Being the Mentor of software design will be a big job for Sutter's Beaverton, Ore., company. For one thing, Mentor just bought out Tektronix Inc.'s CASE division. And Hewlett-Packard resells the same front-end CASE software from Cadre Technologies Inc. that MicroCASE does. "HP is focused on using the tools on their 9000 workstation," says MicroCASE vice president Michael Maerz. "We're not interested in the 9000 — we'll take [workstations from] Sun, Apollo, VAXs [from Digital Equipment Corp.] and PCs and leave the 9000 to HP." Plus, MicroCASE and Cadre have a joint development pact that should produce new products this summer.

Ironically, MicroCASE is moving away from plug-in instruments, a market it helped pioneer, just as that market is starting to take off. Galen Wampler, president of San Jose market research firm Prime Data Inc., forecasts that computer-dependent instruments will grow at a 24%

Adaptive strategies for the evolving CASE instruments market

Chuck D'Ambrosia
president
Applied Microsystems

Focus on supplying "if not the Cadillac, certainly the BMW" of emulators by:

- Concentrating on workstations
- Honing internal design and manufacturing
- Shifting to selling direct and doing plenty of rental business
- Developing own software as well as dealing with Intermetrics and Microtec Research
- Launching subsidiary in Japan and overhauling European distributors

Source: Applied Microsystems

Larry Sutter
president
MicroCASE

Shift from PC plug-in instruments to software development systems by:

- Acquiring Atron for software and emulators
- Joint marketing Microtek International emulators
- Cutting software deals with Microtec Research and Cadre Technologies
- Changing company name from Northwest Instrument Systems to MicroCASE

Source: MicroCASE

rate, from $437 million last year to $1.3 billion in 1992. Toward the turn of the century, these instruments could account for 40% of the instrument business, he says, way up from 2.5% last year. MicroCASE still sells parts of its catalog into that market.

Northwest originally made oscilloscopes and logic analyzers that plugged into PCs, but that business never got them above the $15 million mark, Wampler says. The analyst believes that Northwest has been under some pressure to succeed from its venture capital backers, which, he says, have pumped some $15 million into the company. "Those guys are used to Tandem," Wampler says, "they expect a $50 million to $100 million company." But Wampler points out that MicroCASE has been able to grow faster than most instrument start-ups.

MicroCASE's Software Analysis Workstation is a cluster of instruments and software that runs on a PC to give a "CAT scan of embedded systems," as Maerz puts it. MicroCASE resells software compilers and emulators from third parties to make up a complete development system. Its system is good enough that Intel Corp., the former development systems leader, now resells some MicroCASE products.

Others have praise for MicroCASE, including competitor James Ready, vice president of Ready Systems Corp. Ready concedes that MicroCASE has a "good box, but it comes way late in the design process," he comments. Ready Systems is best known for its real-time operating system, VRTX, but is launching its own set of design tools under new president Aryeh Finegold, a founder of CAE pioneer Daisy Systems Corp.

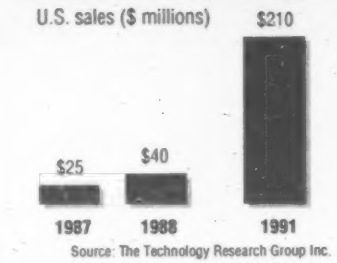
Beating the CASE crowd

Tackling CASE technology from the other direction is Applied Microsystems, which is intent on coexisting with the CASE crowd, rather than being coopted by it. "I'm relatively conservative; I like to take little steps," says president Charles "Chuck" D'Ambrosia. He prefers that his Redmond, Wash., company fit into the "CASE confusion," rather than become a CASE systems integrator. Too much diversification can be dangerous, D'Ambrosia says; "Most small companies don't have the capital to see it through." Applied is profitable and largely self-financed, with under $3 million in venture capital.

Development-system instruments sales

Sales of instruments that fit into CASE are growing steadily...

CASE software for embedded systems sales



...but CASE software is coming on strong

Applied sells emulators, and D'Ambrosia's objective is that they be the best emulators. "I'm not trying to out-Japanese the Japanese, which is to sell on price. All of our products are premium products," he says. "If the industry demands this level of support, they damned well better be able to pay for it." To make Applied's pricey emulators accessible to smaller companies, Applied sells to instrument rental companies. They account for roughly one-fourth of its business.

The Teledyne Controls division of Teledyne Inc., for one, is willing to pay for the support. "It's worth the money for, if nothing else, the product support," says Teledyne Controls vice president James Winchester. He uses Applied emulators to develop the software for on-board and ground support systems for aircraft. Winchester likes Applied's flexibility in the face of CASE. He picked his emulator based on what software it supported.

Another Applied customer, Paul Person, principal software engineer for Satellite Technology Management Inc., has a slightly different take on software support. A third-party debugger he bought from Applied three years ago "wasn't very closely married to the emulator, and I was very fond of the emulator." Person, whose company makes satellite-network systems for banks and airline reservations, says things have come around since then. In fact, as he goes from Motorola Inc. 68010 processors to 68020s, he's looking only at Applied for upgraded emulators.

Market researcher Wampler says Applied is doing all the right things in emulators — concentrating on 32-bit processors and making systems geared for workstations. "They're also emphasizing the software area," he says. "Each year software becomes a larger percentage of their business and that's the way it should be."

Applied makes sure the hardware part of its emulators holds up as well. Applied is a heavy user of CAE and CAD — its workstation-to-engineer ratio is closer to 1-to-1 than 1-to-2, a heavy investment for a small company. Applied also uses manufacturing technologies like a materials-requirement planning system and just-in-time delivery of parts. Vice president Richard Jensen says that to ensure quality the company is installing its own surface-mount assembly line.

Looking abroad

To broaden its perspectives, Applied is looking abroad. "One of our major objectives this year is to go with a vengeance into the international market," D'Ambrosia says. Currently, 7% of Applied's sales are foreign. D'Ambrosia, a former Data I/O Corp. executive, says: "At Data I/O we did 40% of our business internationally. There's no reason we can't do that here." To that end, Applied last month launched a Japanese subsidiary and reshuffled its European distributors last year. □

Putting Japanese venture capital to work in America

Need financing and can't find it in the U.S.? Try Japan. At least one venture capitalist there is interested in funding U.S. electronics start-ups

BY ALDEN M. HAYASHI

U.S. start-ups in need of financing should not overlook Japan as a source of equity. Indeed, the cash-rich Japanese, backed up by their brawny yen, are actively looking for financial opportunities overseas, asserts Mitsuo Goto, executive managing director of the Japan Associated Finance Co. (JAFCO), a Tokyo-based venture capital company.

So far, a few U.S. electronics firms — all in California — have taken advantage of JAFCO's fund: Milpitas-based Attain Inc., a manufacturer of chip test equipment; Micronix, of Los Gatos, and Novellus Systems Inc., headquartered in San Jose, both semiconductor production equipment vendors; and Syquest Technology, a hard disk drive manufacturer, based in Fremont. The average investment was $1 million per company, a pittance considering JAFCO's overall size. The company currently controls a $700 million fund, Japan's largest venture capital account.

Goto strongly asserts that JAFCO will step up its U.S. activities, despite the negative effects of the high-valued yen. Goto is undaunted by the fact that an investment made two years ago at $1 = ¥250 would lose 48% of its value, all other things being equal, if redeemed at the current $1 = ¥129 rate.

"Even with the severe change in exchange rates, I am confident that we can prosper in the United States," says Goto. "The cradle of high tech is in America, so we would like to invest more here." Last November, JAFCO opened a New York City office in order to expand its U.S. subsidiary: JAFCO America Ventures Inc. of Menlo Park, Calif., established in 1984.

When screening investee candidates, Goto says the first thing he looks at is the quality of the start-up's management. In addition, because JAFCO does not often have the resources to conduct a thorough investigation, Goto often bases his judgment on the caliber of the start-up's other investors. The prospective firm's actual product, says Goto, is of secondary importance. "If the company's management is good, we can invest in any industry," he asserts.

"In simple terms, our aim is to direct a flow of capital from the Tokyo capital market to the world," says JAFCO's Mitsuo Goto

Jon Colletti

Indeed, not all of JAFCO's investments have been in the high-technology field. Of the company's total holdings in shares and bonds last September, companies in the finance and services industries accounted for 23% of the total; retail and restaurant, 6%; construction and real estate, 6%; and automotive, 3%. Electronics and computer firms made up for less than a third.

Apparently, Goto knows what he's doing. Roughly 40% of the company's investees went public within four years after JAFCO's initial investment. Such success has grabbed the attention of several U.S. law firms and the Big Eight accounting companies, many of which now want to coinvest with JAFCO, according to Goto. Failures, however, are not unknown. Of the 456 companies that JAFCO has financed to date, 27 have gone bankrupt.

Regarding the company's U.S. investments, Goto says, "Unfortunately, we've not been extremely successful yet." He declines to give more details but he does add, "We are very happy regarding Novellus. They're a good company."

Novellus' strengths notwithstanding, Wall Street's Oct. 19 crash has had a depressing effect on many private companies' initial public offerings. Still, Goto remains adamantly loyal to the private sector. "I have heard that many U.S. venture capitalists made investments in NASDAQ companies because their stock prices became so low.

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But JAFCO has never made an investment in a public company and we will never do that."

A well-connected firm

For U.S. electronics start-ups, linking up with a foreign venture capital firm like JAFCO has its advantages. For one thing, JAFCO can help a U.S. company enter the Japanese market. "We have connections with all kinds of industries in Japan," says Goto. Indeed, due to JAFCO's origins — the company was founded 15 years ago by Nippon Life Insurance Co., Japan's largest life insurance company; The Nomura Securities Company Ltd., the largest securities house in the world; and The Sanwa Bank Ltd., one of Japan's largest banks — Goto boasts ties with many of the major electronics conglomerates in Japan.

Another advantage of using financing from Japan is that Japanese venture capitalists, or Goto at least, appear to be less demanding. While U.S. venture capitalists sometimes expect as much as a 60% return on investment using a compound annual growth rate, JAFCO is satisfied with 25%, according to Goto. However, he cautions that the 25% figure is based on his experiences in Japan. In general, U.S. ventures are riskier, he says. "We do not have enough experience in the U.S. to know what type of figure to expect."

But foreign capital does have its disadvantages. In addition to Internal Revenue Service and Securities and Exchange Commission considerations, U.S. companies contemplating foreign financing should be careful if they do any government contracting, warns Donna M. Sherry, head of the high-technology department of law firm Gaston & Snow of Boston.

Furthermore, Barney Ussher, vice president of MIP Equity Advisors Inc. in Boston, asserts, "People overseas are not as tuned into the market here." The geographical gap can pose other problems. "I cannot get as quick approval for more funds as when I was at Paine Webber," says Daniel Alexander, senior vice president of BMW Technologies Inc., the U.S. venture investment arm of auto giant BMW AG of West Germany.

The geographical distance, however, does have its benefits, particularly if a start-up's financing comes from JAFCO. Goto expresses disdain at the infighting that often occurs in the United States between a start-up's founders and its venture capitalists. "Unless we are asked for help first," he asserts, "we never interfere with a company's management."

As a sign of sincerity and trust, Goto says that when he invests in a start-up, he does not ask for a board of directors seat. Instead, Goto says he relies on coinvestors to protect JAFCO's interests. "That is why I always say that the start-up's coinvestors are very important when we make the original decision to invest."

To date, JAFCO has been the main source of Japanese venture capital for U.S. start-ups, claims Goto. He estimates that of all the Japanese venture capital invested in the United States thus far, JAFCO accounted for roughly 80%. Still, Goto predicts, "Other Japanese venture capitalists will follow, depending on how well we do." □

Japan's venture capital funds

	Size of fund* ($ millions)
Japan Associated Finance	$705
Nippon Investment & Finance	224
Yamaichi Uni Ven	174
Techno-Venture	73
Nikko Venture Capital	70
Japan ASEAN Investment	54
New Japan Finance	43
Kokusai Finance	37
Schroder PTV Partners	35
Sanyo Finance	31
Orient Capital	26
TKC Management Consulting	22
The Diamond Capital Co.	18
Hyogin Capital	18
Daiwa Business Investment	16
Nippon Enterprise Development	15
Kanagyo Kakumaru Investment	13
Cosmo Finance	12
Wako Finance	8
Okasan Finance	8
Toyo Finance	5
Jameel S.I. Corp.	5
Total	**$1,514**

* As of January 1988
Conversion rate: ¥130 = $1
Source: Japan Associated Finance Co. Ltd.

Array processors: Boards and boxes battle it out

It's still a slow-growing niche, but board-level products have added some bite to the $225 million array processor market

BY STEVE GROSS

The array processor market has settled into its stagnant status as a niche that won't go away, but doesn't seem to grow much, either. Total industry sales are around $225 million, and no one is predicting big gains.

Fewer than a dozen players are in the market, and they are divided between the traditional attached processor makers at the high end and some newer circuit board manufacturers at the low end. Prices range from as little as $2,000 for a board-level array processor to a maximum of $265,000 for an attached array processor, and performance ranges from about 8 megaflops to 100 megaflops (million floating point operations per second). Most are 32-bit machines because applications such as sonar signal processing require the speed but not the additional scientific accuracy that 64-bit architecture provides.

While a slowly growing market might seem unattractive, the companies that are in it believe they've found a niche where they can make money, even in the worst of times. However, analyst Jeffry Canin of Hambrecht & Quist Inc., in San Francisco, says he believes array processors are largely a break-even industry these days.

But things aren't as bad as they might appear from the $29.2 million loss recorded last year by Floating Point Systems Inc., the Beaverton, Ore., firm that commercialized the array processor in 1975 and leads the market in installations with 8,000 out of an estimated industry total of nearly 20,000. In May, the company laid off 160 employees, or 20% of its workforce. Canin says the array processor portion of Floating Point's business, which also includes standalone supercomputers, wasn't the main cause of the loss.

Jim Christiansen, array processor product manager at Floating Point, allows that "the array processor business is doing better than the company as a whole . . . Our profit margins are considerably better." Floating Point's products range in price from $45,000 to $100,000 and offer performance ranging from 8 megaflops to 72 megaflops, he says.

"At the high end of the market there don't seem to be any emerging new players. All of the emerging companies are starting at the low end, trying to add boards on to personal computers," according to Christiansen.

He continues: "Obviously [the board makers] will take some business away from us. But there are still a lot of higher end applications that need more power than just a single board can offer . . . .We focus our attention at the high end, where people need multiple computational engines rather than single boards."

According to Canin, after Floating Point, the array processor leaders, based on revenue, are Star Technologies Inc. of Sterling, Va.; CSP Inc. of Burlington, Mass.; Numerix Corp. of Newton, Mass.; and Analogic of Peabody, Mass. Other competitors include Aptec Computer Systems Inc. of Portland, Ore.; Mercury Computer Systems Inc. of Lowell, Mass.; and Sky Computers Inc., also in Lowell.

"The current list of players will probably survive," Canin says. "I don't think you'll see anything like a bloodbath. If the market doesn't look fast-growing it keeps too many competitors from entering it." But, adds

Sharon Farmer

Star Technologies' Robert Collias says chips and boards are rapidly taking over the low end of the array processor market

Canin: "Eventually there [may be a lot of] living dead companies, and there may be some mergers down the road."

Canin estimates that total sales of system and board-level products last year stood at $225 million, and that they will reach about $380 million in 1991, an annual growth of 14% to 15%.

The chief applications for array processors are signal processing, such as radar and sonar analysis for the government; image processing, such as enhancing satellite photos; real-time simulations; processing of oil industry seismic data; and processing medical images such as CAT scans. But, the oil industry market for array processors has declined sharply with the drop in oil prices, and Star Technologies seems to have cornered a large chunk of the medical business with its supply agreement with GE.

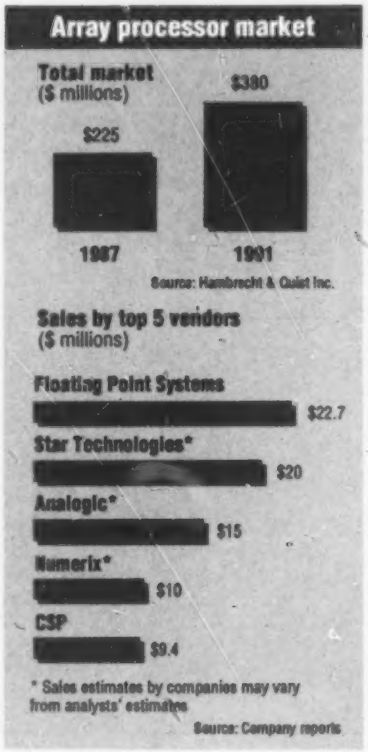
Broadening into boards

Dave Birkner, senior vice president and general manager of the computer design and applications division of Analogic, says it's important to pick the right market. Analogic targets the medical, materials testing and government segments.

"For well-defined imaging and signal-processing applications . . . the array processor is very cost effective. Our business in array processors is certainly growing at the 20% rate," he says. "But for general scientific applications, the array processor is becoming less attractive" because of tough competition from general-purpose minisupercomputers. If he were with a company that sold only attached processors, adds Birkner, "I'd be real worried right now."

Birkner says Analogic, which had array processor sales of about $15 million last year, is focusing on board-level products in its original equipment manufacturer (OEM) business, which accounts for 90% of the firm's revenue. Its boards are designed for computers from Digital Equipment Corp., Hewlett-Packard Co., Perkin Elmer Corp. and others.

"For OEM applications, the board-level products effectively have squeezed out the boxes," he says. "We sell box-level products, but our new products are always available, especially to OEMs, as board-level products." A single 8-inch by 10-inch board for DEC's MicroVAX, for instance, sells for $10,000 and offers 20 megaflops of speed.



However, Birkner predicts that the attached processor business won't disappear because some customers need the units for use with computers that were designed 10 years ago. Redesigning those computers to use array processor boards isn't economical for customers, he contends.

Robert Collins, director of corporate development at Star Technologies, says more than half of his firm's revenue, or about $20 million, came from attached array processors sold for medical imaging, mainly to GE. Signal processing and satellite imaging for the military is a second strong market, and the oil company business seems to be improving, he says.

All things considered, the business is holding up better than he expected, Collins maintains. "Certainly, Floating Point has fallen on some real hard times, and I think a couple of other companies are not real robust . . . But nobody's disappeared lately. I'm a little surprised."

Star's $90,000 ST50, a 50 megaflops machine, and its $265,000 ST100, a 100 megaflops device, are aimed at the very high end of the array processor market. Such machines can compete with general-purpose minisupercomputers, such as machines from Convex Computer Corp., he says, because the array processors can achieve higher sustained speeds for specific applications.

Boards versus boxes

But boards are making impressive headway. "The truth is that chips and boards are rapidly overwhelming the low end of the array processor market. It's very easy to put a board together . . . and get 12 megaflops for less than $15,000 that people can use in an IBM PC-AT," Collins says. "We're not unaware that guys eventually will be able to build more powerful machines using chips."

Still, attached processors offer advantages. "It's still very difficult in the board-level arena to get the software development tools that one needs," says Larry Zagorsky, marketing director for attached processor maker Numerix.

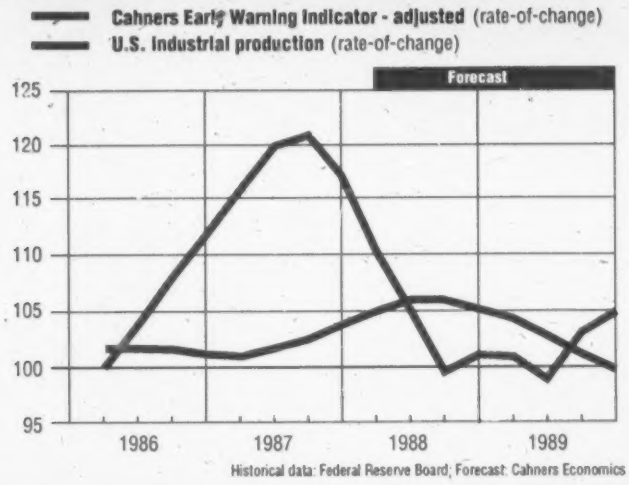
Ray Sansouci, director for marketing at Sky Computers, believes board manufacturers will prosper because they can help standard computer and workstation manufacturers like DEC and Sun Microsystems Inc. compete with application-specific hardware.

"The standard platform companies say they can add in the array processor with a board so they can compete against custom systems," Sansouci points out. "If you leverage a standard product with add-on products like array processor boards, it will do something like a customized workstation does . . . If that's the way it works, Sky will have business for awhile, because the workstation people need boards to go after niches others have already gone after."

Board-level array processors are a niche that companies such as DEC aren't likely to pursue because it's a small market with relatively slow growth, he says. The government, medical and seismic markets are the main focus of the privately owned firm, which Sansouci says had revenue in the $10 million range last year and was "not greatly profitable."

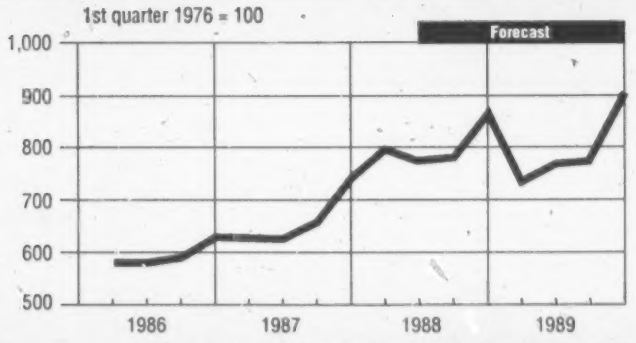
"I don't think that there's a general profitability in the industry," Sansouci notes. "But the board-level companies seem to be doing OK."□

U.S. economic indicators



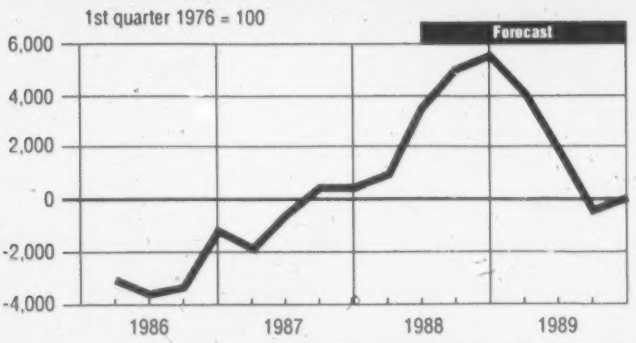
Historical data: Federal Reserve Board; Forecast: Cahners Economics

Automatic test equipment — Revenue index



Historical data: ELECTRONIC BUSINESS; Forecast: Cahners Economics

Automatic test equipment — Profits index



Historical data: ELECTRONIC BUSINESS; Forecast: Cahners Economics

U.S. production remains steady

The indicator peaked in the third quarter of 1987 and is heading for a low point in the second quarter of 1989. But the downturn will be mild and short-lived, according to the CEWI readings. The growth expected in U.S. industrial production has been revised downward slightly for 1988 by Cahners Economics. So instead of slowly accelerating growth this year, industrial output will hover around the 5.1% to 5.9% range all year before heading down in 1989. The reason for the revision? Inventories of imported goods are high. This could result in greater import price competition and U.S. manufacturers could feel the heat. Still, export growth and renewed business investment will steer U.S. industry to steady growth gains this year, albeit somewhat lower than Cahners' predictions several months ago.

More information can be obtained from Elizabeth Baatz, economist, Cahners Economics Department, 275 Washington St., Newton, Mass. 02158.

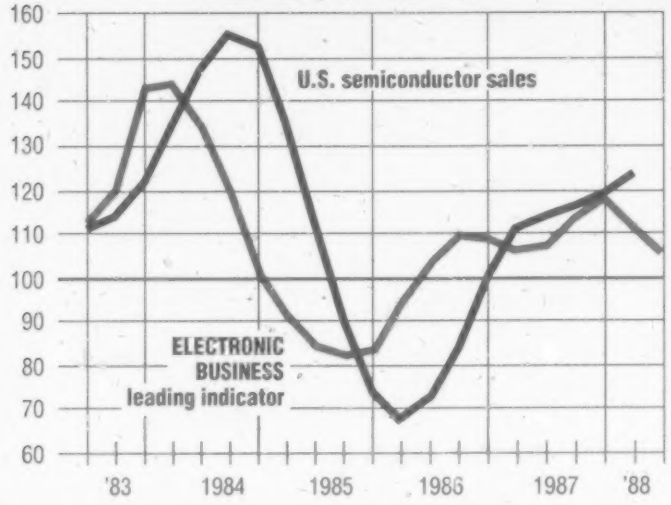
ATE revenue and profit

Manufacturers of automatic test equipment's first-quarter revenue reached $539 million, a 7.7% gain over the prior quarter and an even stronger 27.3% increase over the year-ago quarter's $423 million level. This year, the demand from computer and semiconductor manufacturers for automatic test equipment shows further signs of strengthening. Revenue is expected to rise a sharp 21.5% this year, followed by a 1.1% decrease next year.

ATE manufacturers returned to profitability during the second half of 1987. Not since the second quarter of 1985 has the ATE index shown positive earnings. Profits are expected to show healthy increases through 1988 with a slowdown forecast in mid-1989.

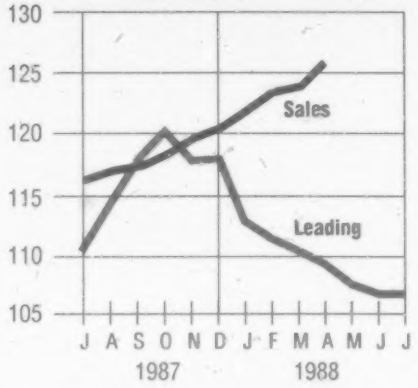
ELECTRONIC BUSINESS leading indicator

Quarterly (rate-of-change)



The ELECTRONIC BUSINESS leading indicator predicts turning points in U.S. semiconductor sales with about a three- to nine-month leadtime. For more information please contact Elizabeth Baatz, senior economist, Cahners Publishing Co., 275 Washington St., Newton Mass. 02158, or call (617) 558-4368

Monthly (rate-of-change)



The ELECTRONIC BUSINESS indicator continued falling in March to 110.7 from a revised 112.1 in February. From its October 1987 turning point peak the indicator has fallen about 8%. By this July, the indicator is likely to have fallen another 4%. All in all, a mild beginning to a downturn in electronics.

Source: Cahners Economics

Electronics industry indicators this month

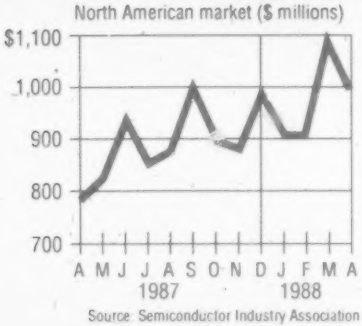
	Latest month	Previous month	Year ago	1987 average
ELECTRONIC BUSINESS leading indicator (rate-of-change, March)	110.7	112.1	107.2	112.0
U.S. semiconductor bookings ($ millions, 3-month average, April)	$1,214	$1,126	$955	$951
Weekly hours of semiconductor production workers (monthly average, March)	40.7	40.1	40.6	40.6
Electronic components leadtime index (1977 = 100, May)	114.3	105.2	101.5	100.7
Standard & Poor's semiconductor price index (1970 =10, monthly average, April)	60.1	59.2	69.2	65.5
Change in electronic components inventories ($ millions, SA, March)	+$52	+$142	-$36	+$46
Contract and orders for plant and equipment ($ billions, SA, March)	$37.8	$38.8	$32.8	$34.4

SA = seasonally adjusted, all other data is not seasonally adjusted

Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, U.S. Commerce Department, U.S. Bureau of Economic Analysis

Semiconductor sales

North American market ($ millions)



Source: Semiconductor Industry Association

Semiconductor book-to-bill ratio

Source: Semiconductor Industry Association

Component inventory-to-shipments

Seasonally adjusted ratio

Source: U.S. Commerce Department